

## Dr. Paul T. Anastas

*By*

*Nikos Thomaidis*

Dear General Secretariat of the Higher Education, Prof. Zoras,  
Dear Rector, Deans, Professors, distinguished Guests from Yale and Yale Club  
Greece, dear Students,  
Dear Paul,

It is a great honor and a deep personal pleasure for me today to present the professional life and achievements of Prof Anastas on the occasion of his nomination as an honorary doctor of the Department of Chemistry of the National and Kapodistrian University of Athens.

It is an additional honor because Paul has Greek origins: Over a century ago, Paul's Grandfather, Nicholas G. Anastas, immigrated to the United States from Naousa, Greece.

Paul was born to Nicholas D. Anastas and Margaret M. Anastas in Boston and grew up in the nearby City of Quincy.

Paul received his bachelors of Science degree in Chemistry from the University of Massachusetts at Boston, and received his Master of Science degree and Doctor of Philosophy in Chemistry at Brandeis University.

Known as the '**Father of Green Chemistry**,' Dr. Paul Anastas' professional life is dedicated to the pursuit of a healthier, more sustainable world. He pursues this goal through Green Chemistry—a field he founded and has significantly advanced in the last three decades. The field rests on the principle that

toxicity is a consequence of inelegant design—that the cancers, degradation, and other toxic effects that were once accepted as “*necessary*” byproducts of chemistry, are unintended consequences that can be designed-out of the equation.

His **12 principles of Green Chemistry** have changed the face of a centuries-old science. He has altered our perception of chemistry – Due to his foresight, we can now approach the problem of chemical toxicity as *a challenge of design*.

Dr. Anastas continues to work for a more sustainable world through accomplishments in laboratories, classrooms, boardrooms, and policy. At Yale University, where he is a professor at both the School of Environment and School of Public Health, he works with students to inspire and empower the next generation of scientists and engineers. He collaborates with educators, deans, and university scientists to transform chemistry education into a realm that embraces innovation. As a result of his advocacy, Green Chemistry courses, degree programs, and training materials are bringing new life to **global chemistry education**. Because of the new perspectives introduced and encouraged by Dr. Anastas, students of chemistry, like students of medicine, are beginning to understand both the power of the tools of their trade and the obligation to wield (γουλιβτ) them responsibly.

Internationally, Dr. Anastas has launched, developed or led Green Chemistry

networks, roundtables, and associations that have redirected innovation in chemistry away from cleaning up after consequences, and toward chemical design that avoids adverse consequences in the first place. In addition to direct benefits for human health and the environment, Green Chemistry has proven to be economically influential. Paul's work has revolutionized the global chemical industry by contributing to countless new products, processes, manufacturing schemes, patents, start-up businesses, and innovations in nearly every sector of the developing and developed world. Because of Dr. Anastas' work, a myriad of new drugs, new technologies, and new products, that are both safe for people and environmentally benign, are entering commerce.

In 1989, straight out of university, Dr. Anastas took his first position in public service as a staff chemist in the U.S. Environmental Protection Agency's (EPA) chemical regulatory program. It was there that he coined the term "**Green Chemistry.**"

He spent a decade at EPA before moving on to the Office of Science and Technology Policy (OSTP) in the Executive Office of the President where he worked on national environmental issues and launched the **Presidential Green Chemistry Awards**. He left that post in 2004 to become the founding director of the American Chemical Society's Green Chemistry Institute. At Yale, Dr. Anastas co-founded and served as director of the Center for Green Chemistry and Green Engineering until being asked by President Obama to

serve as Assistant Administrator and chief scientist at EPA—a position that he held until returning to Yale in 2012.

During his most recent service at EPA, Dr. Anastas realigned the structure of the entire EPA research portfolio around the concept of **sustainability**. He created an integrated, systems-based, solutions-oriented, suite of research programs there that changed policy of chemicals use.

In the midst of his work at EPA, Dr. Anastas was called upon to play a leading role in the Agency's response to multiple national and international crises, including the **Deepwater Horizon Oil Spill** and the **Fukushima Nuclear Incident in Japan**. During the BP Oil Spill, Dr. Anastas was responsible for overseeing scientific work to support decisions and actions related to dispersant use, air monitoring, and water monitoring. Throughout the course of the spill, Dr. Anastas stressed the importance of communicating government science to the public and providing the latest and best information to those whose lives were being impacted most.

During the Fukushima nuclear incident in Japan, Dr. Anastas coordinated Agency efforts to address urgent scientific questions on radiation transport and led a team for providing guidance to American citizens in the affected area of Japan. Working from the EPA Emergency Operations Center for several weeks, he built teams of scientific experts, communication specialists, and emergency operations staff to ensure that all actions, decisions, and

information released to the public were accurate and held to the highest standard of **scientific integrity**. During his time in this leadership role, he continuously stressed the importance of science that is **sound, transparent, and rapidly available to the public**.

While working as Assistant Director for the Environment at the White House Office of Science and Technology Policy in 2001, Dr. Anastas also played a critical role in addressing important scientific questions that arose after the **September 11<sup>th</sup> terrorist attacks**. He worked with a team to answer urgent public health questions about the fate of chemicals released into the atmosphere from the Trade Center site. In all of these cases of crisis and tragedy, Dr. Anastas brought an **unwavering commitment to scientific integrity** into the U.S. Government's coordinated response.

Dr. Anastas' work is international in its reach. Scientists, environmental leaders, and public health professionals around the world, especially in developing nations, have embraced the principles of Green Chemistry. For example, Paul helped found and launched the Pan African Chemistry Network (PACN) in an effort to unite and empower Africa's growing scientific community to harness the power of Green Chemistry for sustainable development and public health. Dr. Anastas has also helped found Green Chemistry networks in Africa, India, China, South America, and elsewhere to help emerging nations approach challenges of development in safe and

sustainable ways. Dr. Anastas' effort to realign EPA's research around the concept of Sustainability has also served as a model to the international community.

In addition to his scientific, educational and policy work, Dr. Anastas is a dynamic speaker and persuasive writer. He has written scores of scientific papers, journal articles and authored several editorials, chapters, and books.

Upon his return to Yale University, he advanced further the concepts of Green Chemistry.

To highlight his scientific impact, three brief cases can provide a glimpse into Dr. Anastas' contributions.

The first major contribution is the

- **Renewable Energy Storage and Carbon Dioxide Utilization:** One of the great challenges of renewable energy is its storage, to avoid the current large energy losses associated with distribution. The Anastas Group has developed new cobalt catalysts for water-splitting to enable the storage of renewable energy as **hydrogen**. Anastas designed and synthesized the first disordered cobalt coordination polymer catalyst, to be efficient and selective for water oxidation, and generate fuel from water and sunlight. His group created the ability to utilize seawater, rather than pure drinking water, to generate hydrogen. When that hydrogen is combusted, the product is pure water yielding not only a solution to a renewable energy challenge but also advancing energy efficient desalination as well.

The catalyst and its applications have been patented<sup>4</sup> and Paul created **Catalytic Innovation Inc.**. The company's technology is pursuing carbon

dioxide utilization and is currently a finalist in the \$20M Carbon X-Prize.

The 2<sup>nd</sup> achievement focuses on

- **New Synthetic Methods to Transform Bio-based Feedstocks:** New synthetic methodologies allow the transformation of complex biomass mixtures into a large portfolio of usable molecular building blocks and supported the transition from a petroleum-based chemical enterprise to one that utilizes biomass for specialty and bulk chemicals alike. Coupled with this work was an interesting research collaboration between the Anastas Group and Grison Group that recognized that a major environmental technology to clean hazardous waste sites is **phyto-remediation** with uptake of pollutants such as plants.

The third major research line is

**Molecular Design for Reduced Toxicity:** Anastas has been considered a leader in advancing science of designing molecules *de novo* to disfavor persistence, bioaccumulation, biomagnification, and toxicity. Principle 4 of the “12 Principles of Green Chemistry” published in 1998, emphasizes the imperative of striving to design molecules with minimal hazard. Anastas’ foundational paper, Toward a Comprehensive Molecular Design Framework for Reduced Hazard<sup>9</sup>, set the conceptual basis for his efforts as principal investigator of the NSF-funded, Molecular Design Research Network (MoDRN).

Paul Anastas’ career has included basic research, teaching, government

service, founding manufacturing companies, launching international not-for-profit organizations, international public outreach, and mobilizing capital investments into sustainable technologies.

Paul published more than 200 scientific papers and patents and 14 books co-founded 5 companies, and served:

4 years at U.S. Presidential Administrations

15 years in the US Government

15 years at Yale University

In summary, Paul Anastas started Green Chemistry as a thread of an idea and today, the thread is present in our education systems, academic conversations, policy decisions and manufacturing schemes. The tapestry is not yet fully woven, but, because of Dr. Anastas' scientific achievements, the seams are in place. Because of his efforts to inspire, educate, and mobilize, a rapidly swelling global network of green chemists is standing ready at the loom.

Through his foresight and action, Dr. Anastas has changed the world. Scores of hazardous products have been taken off store shelves, people around the world have been exposed to fewer toxic chemicals, the environment is cleaner, and lives are safer. Because of his efforts, the scientific community can now design safety into the products we use daily, and a new generation of scientists is empowered with the tools to incorporate public and



environmental health into the foundations of their scientific work.

Despite of all his achievements Paul's Greatest Source of Happiness is his Family, his wife Julie, and his daughters, Kennedy and Aquinnah

For all these reasons, it is a great honor and pleasure for me, but I am sure I also speak on behalf of all the members of our Department and University, to welcome Dr. Paul Anastas to the honorary doctors of the Chemistry Department. We are looking forward to a firm, creative and fruitful collaboration.

Dear Paul, thank you very much for all your achievements in science and policy, and please accept our most sincere congratulations and welcome.

Citations:

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